Applying Optimization and Artificial Intelligence to NASA's Communications Networks: Cognitive Real-Time Link Layer Adaptations to Rapid Constellation Planning

Completed Technology Project (2015 - 2019)

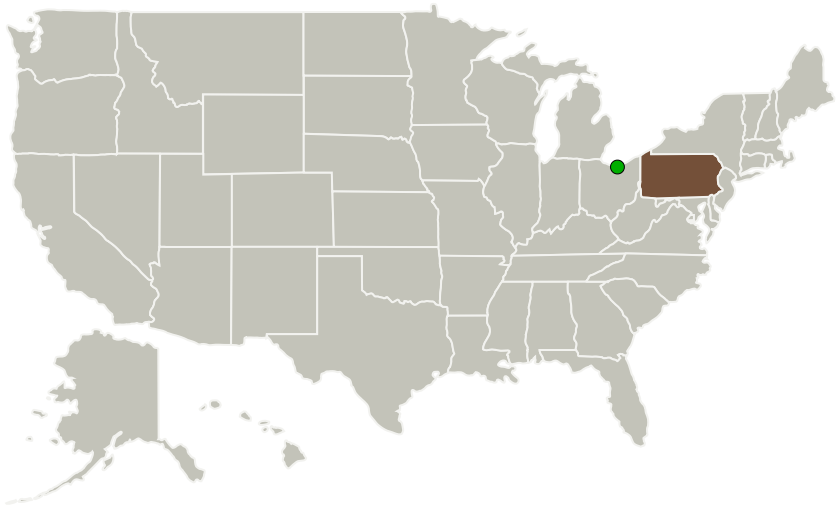
Project Introduction

In a communications channel, the space environment between a spacecraft and an Earth ground station can potentially cause the loss of a data link or at least degrade its performance. The research plan detailed in this proposal describes an adaptive, intelligent MAC protocol for software-defined radio space-communications applications. It consists of sensing, predictive, and decision mechanisms that will drive an overall framework to sense current channel conditions, predict the near-future channel conditions, and then automatically reconfigure based on these inputs. The reconfiguration of the SDR will be based on attempting to maintain the performance requirements for the data link, such as bit error rate, up-time, reliability, and/or data rate. Upon successful testing onboard the International Space Station using the Space Communications and Navigation (SCaN) Testbed, this research effort will change the TRL level from TRL 3 to TRL 5 in the area of TA05. Ultimately, it will potentially push the state-of-the-art performance limits of a space-based communications network.

Anticipated Benefits

Ultimately, it will potentially push the state-of-the-art performance limits of a space-based communications network.

Primary U.S. Work Locations and Key Partners



Applying Optimization and Artificial Intelligence to NASA's Communications Networks: Cognitive Real-Time Link Layer Adaptations to Rapid Constellation Planning

Table of Contents

Applying Optimization and Artificial Intelligence to NASA's Communications Networks: Cognitive Real-Time Link Layer Adaptations to Rapid Constellation Planning

Completed Technology Project (2015 - 2019)

Organizations Performing Work	Role	Type	Location
Pennsylvania State University-Main Campus(Penn State)	Lead Organization	Academia	University Park, Pennsylvania
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations
Pennsylvania

Project Website:

https://www.nasa.gov/strg#.VQb6T0jJzyE

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Pennsylvania State University-Main Campus (Penn State)

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

Hung D Nguyen

Principal Investigator:

Sven G Bilen

Co-Investigator:

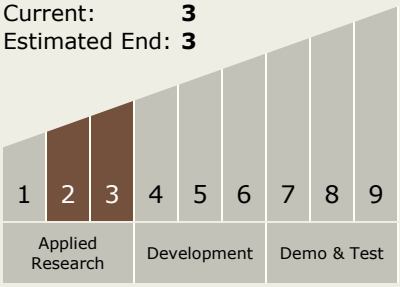
Timothy M Hackett

Applying Optimization and Artificial Intelligence to NASA's Communications Networks: Cognitive Real-Time Link Layer Adaptations to Rapid Constellation Planning

Completed Technology Project (2015 - 2019)

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - TX05.5 Revolutionary Communications Technologies
    - TX05.5.1 Cognitive Networking

Target Destination

Earth